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Multi-level innovation policy in southern EU countries.

An additionality evaluation of the Italian and Spanish public interventions

Alberto Marzucchi*

Abstract

The present paper aims to analyse the innovation policies implemented in Italy and Spain. It adopts a multi-level perspective to investigate the effects induced by regional and national public supports and a multi-dimensional approach to disentangle the different types of additionality impacts on firms' innovation process. In particular input, output and behavioural additionality are considered. The results, obtained through a propensity score matching estimation of the average treatment effect on treated (ATT) implemented on CIS 4 microdata, capture a complex picture. In both the countries only national policies increase R&D investment. As for output additionality, whereas Spanish regional and national policies enhance the economic exploitation of new products and patent applications, Italian interventions boost only process innovation. As for the behavioural additionality, mixed evidences emerge for regional Italian policies, for which some negative effects are also found, Italian national interventions positively affect interactions with other firms and research partners, Spanish policies (both national and regional) induce funded firms to engage in formal training and to interact more with business and research partners. A tentative analysis of the "risk of policy failure" is also provided. Apart from Italian regional policies, for which no significant result is found, the Spearman's rank correlation coefficients reveal that the (rank of the) ATT calculated for each additionality measure is negatively related to the (rank of the) corresponding coefficient of variation. High ATTs are thus correlated with low dispersions.

Keywords: innovation policy, R&D subsidies, additionality

JEL classification: O31; O38

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1. Introduction

Two contrasting forces characterise innovation policy particularly in southern EU countries. Whereas the support to innovation activities is a necessary condition to reach the objectives of the “Europe 2020” strategy, the ongoing economic crisis is pressuring governments to reduce their direct intervention in support of the economic systems, or at least to increase the effectiveness and efficiency of the policy actions. In this framework the contribution to the policy-learning process coming from the evaluation of the innovation policy is of particular importance, as the information on the effectiveness of previous interventions allows for a better shaping of future policy objectives and means.

This paper contributes to the empirical literature on the impacts of the innovation policy interventions by focusing on two southern EU countries, namely Italy and Spain. To analyse the multi-level systems of policy of the two countries, the paper is focused on the public supports initiated both at the regional and national level. More specifically, the aim of this work is twofold. At first, it aims to provide an evaluation of the additionality of the policy interventions, by analysing the net effects that would not have occurred in absence of the public support. In doing this three dimensions of the additionality are considered. In addition to the standard input and output additionality, which assess whether the policy has been able to overcome the underinvestment in R&D and the underproduction of innovation generated by the likely presence of market failures (Arrow, 1962), an analysis of the behavioural additionality is also provided. This latter, whose concept has been developed upon the seminal contribution by Buisseret et al. (1995), is focused on the strategic and behavioural changes induced by the public intervention and can assess whether the policy action has been able to overcome or mitigate the presence of potential system failures (e.g. Smith, 2000; Metcalfe, 2005; Malerba, 2009). With this respect, in the paper, an analysis of the effect of the policy on the networking activities and on the learning process of the beneficiaries is provided.

The second main aim of this work lies in the tentative analysis of the “risk of failure” of the policy. Whereas the majority of the contributions to the empirical literature on the evaluation of the innovation policy deal with the average effect of the public intervention, it is quite unclear whether an higher effect is associated to a higher or lower dispersion of the impact across the beneficiaries.

The analysis provided is based on microdata on manufacturing firms coming from the fourth wave (2002-2004) of the Community Innovation Survey, which allows for a comparison across the two countries. To deal with the likely presence of selection bias, the additionality evaluaton is carried out with by employing a set of propensity score matching algorithms. The analysis of the “risk of failure” of the policies is based upon the Spearman’s rank correlation between the coefficients of variation of the effects, calculated for each additionality measure considered, and the corresponding levels of (normalised) average impact.

The reminder of the paper is organised as follows. After this brief introduction Section 2 deals with the theoretical and empirical background. This provides in particular a review of the additionality concept and of the empirical contributions aimed at evaluating innovation policies implemented in Italy and Spain. The third section presents the econometric approach, the characteristics of the dataset and of the variables. Section 4 reports the results of the additionality evaluation and of the analysis of the “risk of policy failure” for the regional and national innovation policy implemented in Spain and in Italy. Fifth section concludes.

2. Theoretical and empirical background

2.1 The additionality of innovation policy

The concept of additionality, in its input dimension, dates back to the standard neoclassical approach to the innovation policy (Arrow, 1962), according to which the presence of market failures (i.e. non-perfect appropriability, uncertainty, indivisibility and increasing returns) creates a systematic mismatch between private and public incentives to innovate and a consequent underinvestment in innovation activities. This implies that innovation policy interventions should be aimed at stimulating an additional amount of private investment in R&D in order to reach the social optimum. In this perspective input additionality is concerned with whether the additional R&D investment activated by the policy is higher than the subsidy received (Cerulli, 2010) or, more generally, with the amount of resources and innovative inputs (i.e. R&D investment) that would not have been allocated without the policy (Georghiou, 2002; 2004; Clarysse et al. 2004).

The neoclassical approach is not concerned only with the optimal level of investment in R&D, as an underinvestment in R&D, due to the strict linear relation between inputs and outputs, is expected to generate an underproduction of innovation. Hence, innovation policy interventions are eventually aimed at increasing the amount of innovation outputs produced by private actors. In this sense the output dimension of the additionality concept is focused on the amount of outputs that would not have been achieved without the policy intervention (Georghiou, 2002; 2004; Georghiou and Clarysse, 2006). Several types of output can be considered in such an analysis, however, in a microeconomic perspective, the focus can be on the immediate results of the innovation projects supported by the public intervention (e.g. new products or processes and patents) and their economic outcomes (e.g. improved business performances as resulting from the introduction of new products or processes) (Georghiou, 2002).

Although quite straightforward both the input and output dimensions of the additionality concept are affected by some limitations arising from their anchorage to the standard neoclassical rationale. In particular, considering the beneficiary as a “black-box”, they fail to take into account the complexity of the innovation process and the organisational, behavioural and strategic impacts of the public support (Georghiou and Clarysse, 2006). To overcome this limit the behavioural dimension of the additionality has been developed in the literature: this is defined by Buisseret et al. (1995), in their seminal contribution, as “the change in a company's way of undertaking R&D which can be attributed to policy actions" (p. 590). Even if the behavioural additionality is still vaguely defined in the literature, it is particularly useful for capturing three types of changes induced by the policy intervention. First, the acquisition and improvement of knowledge, capabilities, organisational routines and strategies (Georghiou and Clarysse, 2006; Breschi et al., 2009). A second type of effect that can be analysed using the concept of behavioural additionality is the impact on the beneficiaries' networking and interactions with other organisations (Georghiou, 2004; Fier et al., 2006; Georghiou and Clarysse, 2006; Hall and Maffioli, 2008; Breschi et al. 2009). Finally, as noted by Geoghiou (2004), Bach and Matt (2005) and Georghiou and Clarysse (2006), focusing on the acquisition of competences in new or extended technologies, on the creation of novelty and capacity to adapt to future situations, it is also possible to assess whether a given policy intervention has been able to overcome lock-ins into non-preferable technologies. The analysis of this types of effects allows for the concept of behavioural additionality to be consistent with the evolutionary theorizing and the system of innovation approach, according to which the policy rationale has to be found in the system failures (e.g. Smith, 2000; Metcalfe, 2005; Malerba, 2009) rather than in the market failures. More precisely, the behavioural additionality evaluation can be used to assess the effectiveness of the policy interventions aimed at overcoming the system failures that occur at the level of the beneficiaries, as the natural unit of analysis of the additionality evaluation is the firm or the organisation supported by the policy.

2.2 Empirical literature on the additionality of Italian and Spanish policies

Several studies investigate the additionality of the Italian and Spanish policies aimed at supporting firms' innovation activities.

Cefis and Evangelista (2007) analyse the impact on Italian firms' expenditure in innovation activities of policies initiated at different levels (i.e. local or regional, national and European). Adopting an OLS control function approach on CIS3 (1998-2000) data, their findings point to a positive input additionality effect of the local and national policies and of the supporting interventions framed within the European Framework Programme. Some output additionality impacts also emerges for the interventions included in the European Framework Programme and, to a lesser extent, for sub-national policies. To reduce potential endogeneity problems Cefis and Evangelista (2007), merging CIS2 (1994-1996) and CIS3, analyse the effect of a lagged policy support (considering together the different levels of intervention). An additional effect is found only on the firms' total expenditure in innovation activities. This positive results is not confirmed when using as outcome variables the variation rate of the additionality measures considered[1].

More recently Cerulli and Potì (2008), merging the Italian CIS3 with balance sheets data, investigate the input additionality of innovation policies targeted to Italian companies, not distinguishing among the different levels of intervention. The results, obtained from OLS, propensity-score matching and a Heckman selection model, generally support the presence of input additionality (in terms of R&D expenditure, R&D intensity on the turnover and R&D per employee). Some more mixed evidences emerge when considering the output additionality in terms of policy effect on the turnover due to product innovations. Interestingly, Cerulli and Potì (2008) further disaggregate their analysis by macro-region, sector[2] and firm's size. Their results point to a total crowding-out effect in low knowledge-intensive services sector, very small firms (10-19 employees) and auto-vehicle sector.

Italian policy has been further investigated by works aimed at analysing the impact of specific funding mechanisms. Barbieri et al. (2010) investigate the impact of the law 46/82, which consists of two parts, establishing the Fund for Applied Research (FSRA) (which converged in 2001 in the Fund for Research Support (FAR)) and the Fund for Technological Innovation (FIT) respectively. In brief, the former is aimed at supporting firms' investment in applied research activities including the collaborations with research partners, while the latter is focused on applied innovations and the development phase of the firms' R&D activities. The analysis carried out by Barbieri et al. (2010) is based on a panel created upon three waves of the Capitalia (MedioCredito Centrale) surveys (1995-1997, 1998-2000, 2001-2003). The results emerging from a difference-in-difference approach point to an ambiguous evidence on the input additionality of the law 46/82. The only positive and significant effects are those emerging from the difference between the second and the first wave analysed. More precisely, it is noticeable a positive and significant impact of the first part of the law (FSRA) on the R&D expenditure and of the second part of the law (FIT) on the R&D personnel. To control for the

[1] Variables capturing the cooperation attitude are also included. In Cefis and Evangelista (2007) a comparison with the impact of regional, national and European policies on Dutch firms' innovation activities is also provided.

[2] Sectors considered are: high-tech, medium-high tech, medium-low tech manufacturing sectors; knowledge intensive and low-knowledge intensive services. In addition to these, three specific manufacturing sectors are considered: i.e. auto-vehicle, mechanics, chemicals.

concurring effects of other incentive schemes, Barbieri et al. (2010) employ a difference-in-difference-in-difference method. The results point to a lack of effectiveness of the law when interacted with other policy schemes.

Merito et al. (2010) investigate FAR's predecessor, i.e. the Fund for Applied Research (FSRA). In particular the last two years of its activity, i.e. 1999-2000, are considered. FSRA effectiveness is evaluated through a matching approach applied over Amadeus (Bureau va Dijk) data merged with information on patenting activities stemming from the Delphion dataset. The focus of the work is mainly on the output additionality effects of the FSRA, two (2002) and four years after the public support (2004). More precisely, the analysis aims at capturing the impact on the market success, labour productivity, patenting activity, labour force composition and employment growth. The only significant effects (i.e. a positive impact on the patent applications and a negative one on the composition of the workforce) are registered in the short-run (2002), while none of the outcome variables is found to be significantly affected by the policy support in the medium-long run (2004). However, the effect of the intervention seems to be dependent on the type of beneficiaries: when the analysis is limited to the SMEs, FSRA is found to be positively affecting the composition of the workforce, the patenting activity (both in the short- and medium-long run) and the employment growth (in the medium-long run).

A more recent study dealing with the evaluation of the FAR is the one by Cerulli and Potì (2010), who employ a panel covering the period 2002-2004 created upon data collected by the Ministry of Research (MIUR) and the Italian National Institute of Statistics (ISTAT). The comprehensive econometric analysis provided sheds, at first, some light on the input additionality effects. The evidence emerging from a structural model, in its reduced form regression equation, points to a positive effect on private R&D spending. Cerulli and Potì (2010) also analyse the heterogeneity of the effects, investigating the presence of input additionality in different subgroups of firms. Input additionality is found to characterise large and very large companies, low-tech, high and medium-high tech firms, as well as companies located in the North and the Centre of Italy. Another interesting insight from Cerulli and Potì (2010) is the analysis of the effect of the input additionality on the level of output additionality, captured by the number of patents. Through a matching technique, for each firm, an idiosyncratic level of additionality and the "own R&D expenditure" are estimated and used as predictors, together with the amount of subsidy, in a poisson regression. The coefficient of the idiosyncratic additionality term turns out to be positive and significant, meaning that the input additionality effect of the policy induces a higher innovation performance in terms of patent applications[3].

As far as the FIT is concerned, this is evaluated by De Blasio et al. (2011) with a regression discontinuity design approach, which exploits a cut-off in the programme due to the unexpected shortage of funding in March 2002. The evidence, based on data from the Ministry of Economic Development and the Cerved dataset of financial statements, points to a substantial lack of effectiveness: subsidised firms do not invest more in either tangible or intangible assets.

In addition to the works reviewed above, at the best of our knowledge, the contribution by Bronzini and Iachini (2011) is the only one that analyses a specific regional innovation policy. By using CERVED balance sheets data and employing a regression discontinuity design approach, based

[3] See Cerulli and Potì (2010) also for an analysis of the differences in the effects resulting from various sub-types of intervention within the FAR and for an investigation of the structural differences, concerning also the different economic performances (i.e. productivity, profitability and turnover's growth rate), between firms performing crowding-out and firms performing additionality.

on the cut-off generated by a threshold in the score obtained in the projects' evaluation process, Bronzini and Iachini (2011) assess the input additionality of the regional R&D subsidy implemented in the Emilia-Romagna region. This is found to be ineffective in fostering private investment (tangible and intangible), the level of employment and labour composition. However, when the analysis is carried out by firm's size, there emerges a positive effect on private investment of small companies.

Moving to the empirical contributions aimed at evaluating innovation policies in Spain, a first work to be mentioned is the early contribution by Busom (2000), who investigates the input additionality of a programme implemented in 1988 by the Centre for Technological and Industrial Development (CDTI), an agency of the Spanish Ministry of Industry. Through OLS regressions, the mean fitted values of the R&D expenditure and the R&D personnel for participants and non participants are obtained. By comparing these values Busom (2000) concludes that the policy positively affects both the input additionality measures considered.

A more recent empirical contribution focused on Spanish public support schemes is the one by González and Pazó (2008), who investigate the input additionality of Spanish policies in the period 1990-1999, without distinguishing among the different levels of intervention. They employ a matching technique over the panel coming from the Spanish Survey on Firm Strategy. The evidence points to the absence of crowding-out between public and private spending. Furthermore, public funding is found to be a necessary condition for some types of firms (small and operating in low technology sectors) to engage in R&D activities.

By exploiting the same dataset for the period 1998-2005 Garcia-Quevedo and Afcha-Chávez (2009) analyse the input additionality of national and regional policy interventions. Policy support schemes initiated at the national level positively affect the intensity of R&D investment; however, a similar result is not found to be in place for regional interventions, for which the policy impact is not significant.

The last three contributions here reviewed (Busom and Fernández-Ribas, 2008; Magro et al., 2010; Afcha-Chávez, 2011) introduce some new insights in the literature, as they are focused also on the behavioural additionality of innovation policy. The work by Busom and Fernández-Ribas (2008) is focused on the cooperation dimension of the behavioural additionality. To evaluate the impact of the national funding the work employs data coming from the Spanish Innovation Survey (period 1996-1998). At first, the authors adopt a structural model, in which the decision to participate in the policy is modelled, as well as the equations of partners selection (i.e. on the one hand customers and suppliers and, on the other hand, public research organisations). However, after having estimated a reduced form equations of their structural model, Busom and Fernández-Ribas (2008) turn to a matching approach[4]. The results of the empirical analyses show that the policy has a positive impact on the cooperation between funded firms and public research organisations and, to a lesser extent, on the interactions between supported companies and private partners.

Afcha-Chávez (2011) consider the impact of Spanish policies, initiated both at national and regional level, on the cooperation with customers or suppliers and universities or technological centres. The analysis is carried out on the basis of data coming from the Spanish Survey on Firm Strategy (period 1998-2005). As in Busom and Fernandez-Ribas (2008), Afcha-Chávez (2011) tries to employ a structural approach, but then moves to a propensity score matching estimation, given the endogeneity of the public support. The results point to a positive impact of both regional and national policy on the likelihood to establish a cooperation with an university or a technological centre. Nevertheless, both the regional and the national programmes have no significant effect on the cooperation with customers or suppliers.

[4] To deal with the endogeneity of the policy support in the estimation of public-private cooperation equation.

The last work here reviewed is the one by Magro et al. (2010), which at the best of our knowledge represents the only attempt to evaluate a specific Spanish regional policy, namely a programme implemented in the Basque Country. By adopting a matching technique they analyse whether public funding rises the propensity to collaborate, increases the capacity of the firm to participate in international R&D programmes, leads to systematic R&D behaviour within the firms. The evidence provided leads to conclude that the policy programme has a positive effect on all the three aspects of the behavioural additionality.

Despite the large of evidence provided, the empirical literature dealing with the effectiveness of the policies implemented in Italy and Spain suffers from two main limitations that this paper aims to overcome. At first proper comparisons are not allowed due to the differences in the effects considered, data and methodologies employed. Second, almost all the contributions (with the exception of Cerulli and Potì, 2010) analyse the average effect of the participation in the policy, without taking into account that even a large and positive average effect can be associated to a high risk of dispersion of the impact itself. In other words, whereas the return of the policy is properly analyse, no insights on the "risk of failure" of the intervention are provided.

2.3 The multi-level system of policy

In analysing the policies implemented in Italy and Spain this papers adopt a multi-level perspectives that finds its theoretical and empirical anchorage in recent contributions dealing with regional innovation policy. In the early literature on regional systems of innovation the relevance of intra-regional or localized relations as major drivers of learning and innovation has led to think that the regional policy-maker is in the best position to implement innovation strategies focused on the promotion of networks and cluster-type instruments. Such an increasing attention on the regional level of policy has been justified by the idea that public intervention needs to be "context-specific and sensitive to local path-dependency" (Amin, 1999, p. 368). However, this perspective fails to take into account the necessary inter-connections between different levels of government. Innovation is a phenomenon that occur at different scales and it is shaped by institutional aspects that might supersede the regional level and pertain to the national or even supra-national ones (Howells, 1999; Boschma, 2005). Due to this, public interventions should be seen as parts of a multi-level system of policy or governance (Cooke, 2002; Kaiser, 2003), in which different support schemes are initiated at different levels. This perspective seems to be particularly consistent with an evolutionary or system-kind of approach, in which policies targeting the connectivity of actors within close regional systems of innovation are unlikely to be successful because they do not consider the necessary diverse and complex knowledge to be acquired from external sources that can complement the regional knowledge base (Bathelt et al., 2004; Gertler and Levitte, 2005; Boschma and ter Wal, 2007; Uyarra, 2010). In this sense it seems that the national or even supra-national levels of government may be in a better position to coordinate, to say the least, policy interventions aimed at solving system failures.

This multi-level analysis seems to be particularly necessary in the case of the two countries here analysed in which the national and the regional levels of policies are implemented according to different objectives and modalities. Italian policies initiated at the sub-national levels, with respect to national ones, are generally characterised by a lower public contribution, being mainly targeted to SMEs and aimed at supporting less formalised and process innovation (Cefis and Evangelista, 2007; Barbieri et al., 2010). Similarly, also Spanish regional policies are characterised by a smaller scale and scope and by a higher attention to less formalised innovation activities than the national interventions (Garcia-Quevedo and Afcha-Chávez, 2009; Afcha-Chávez, 2011). It is important to mention, with this respect, the usefulness of the behavioural additionality evaluation, as the standard input (and output) additionality assessment, by analysing the formal engagement in (and the results of) innovation activities, might lead to an underestimation of the effects.

3. Empirical application

3.1 Econometric strategy

In evaluating the additionality of innovation policies the focus is basically on the net treatment effect of the public intervention. In other terms, the objective is to measure the impact that is directly caused by a given treatment, in this case the policy. This net effect can be seen as the difference between the outcome observable after the treatment and the outcome that would have been observed without the treatment, i.e. the counterfactual. Denoting by Y_{i1} the outcome in case of treatment and by Y_{i0} the outcome in case of non treatment, the effect on a single unit is $\Delta_i = Y_{i1} - Y_{i0}$.

As noted by Holland (1986), the possibility to use this kind of approach is limited by the fundamental problem of causal inference: it is not possible to observe both the outcome in presence and in absence of the treatment on the same unit. The statistical solution to this problem is based on the concept of average causal effect, and the parameter of interest becomes the average treatment effect on treated (ATT):

$$ATT = E(\Delta \mid D=1) = (Y_1 - Y_0 \mid D=1) = E(Y_1 \mid D=1) - E(Y_0 \mid D=1) \qquad (1),$$

where D denotes the binary treatment status. While $E(Y_1| D=1)$ can be estimated by the mean outcome of treated units, $E(Y_0|D=1)$ (i.e. the potential outcome in absence of treatment), cannot be observed, as it is not possible to detect the outcome that would have been reached in absence of the support for treated units. In a situation in which units are randomly assigned to the treatment $E(Y_0|D=1)$ could be estimated by $E(Y_0|D=0)$, because on average treated and non treated do not differ so that $E(Y_0|D=1)=E(Y_0|D=0)$. Nevertheless, random assignments are very unlikely in innovation policy, as in most of the economic policies. On the one hand, some beneficiaries can self-select themselves, while, on the other hand, policy-makers can deliberately select recipients with certain characteristics with either a "picking the winner" or a "aiding the poor" strategy (Cerulli, 2010). The result is that treated and non treated units are systematically different; thus, estimating the counterfactual with the mean outcome of non participants is a source of bias, namely the selection bias. This can be generated, on the one hand, by the omission of observable variables that partly determine both the treatment status and the outcome (selection on observables). On the other hand, selection bias can be caused by unobserved factors that determine both the treatment status and the outcome (selection on unobservables) (Cameron and Trivedi, 2005). A device to control for the selection on observable is the use of matching estimators, which aim at pairing treated units with non treated ones that have the same observable characteristics, so that the difference in the outcome variable is only due to the treatment.

At the basis of matching methods there is the conditional independence assumption:

$$Y_0, Y_1 \perp D \mid X \qquad (2)$$ [5]

Accordingly outcomes are independent of programme participation, conditional on a set of observables characteristics X. Conditioning on X is like assuming that the assignment is randomised and that unobservables are not relevant for the participation (Dehejia and Wahba, 2002). In order to have a consistent matching procedure another assumption is needed: the so-called “stable unit-

[5] A weaker version of (2), i.e. $Y_0 \perp D \mid X$, can suffice (Heckman et al. 1998; Cameron and Trivedi, 2005)

treatment value assumption" or SUTVA (Rubin, 1986). SUTVA implies that the outcome for individual *i* must be independent to the treatment given to individual *j*; this is a very strong assumption in social sciences and in particular in the evaluation of innovation policy due to the likely interactions among the units of analysis. In addition to these assumptions, for a correct matching estimation of the ATT, the common support condition is also necessary:

$$0 < \Pr(D=1 \mid X) < 1 \qquad (3)$$ [6]

If (3) is not satisfied there are only treated or non treated units for certain *X* vectors, thus making the matching impossible.

Given (2), SUTVA and (3) it is possible to overcome the inability to observe the potential outcome in absence of treatment for the participant units. As $E(Y_0|D=1,X) = E(Y_0| D=0, X)$, the unobservable term $E(Y_0|D=1,X)$, can be recovered from $E(Y_0| D=0, X)$. Hence,

$$ATT = E(Y_1 \mid D=1, X) - E(Y_0 \mid D=0, X) \qquad (4).$$

Intuitively matching methods are based on the idea that the effect of treatment is estimated through the difference between the mean outcome of participants and the mean outcome of the non treated units that the same set of observable characteristics *X*. Theoretically, in order to have an unbiased estimator of the treatment effect, it should be crucial to match a treated unit with a non treated one that has exactly the same vector of *X*. However, if the vector has a high dimension it can be difficult, if not impossible, to find appropriate matches for all the treated units. Rosenbaum and Rubin (1983), in their fundamental paper, propose a device which helps to reduce the dimension of conditioning: the propensity score. Propensity score is the conditional probability of receiving the treatment given *X*:

$$P(X) = \Pr(D=1 \mid X) \qquad (5).$$

Drawing on Rosenbaum and Rubin (1983), when (2) holds,

$$Y_0, Y_1 \perp D \mid P(X) \qquad (6):$$

when outcomes are independent of programme participation conditional on *X*, they are also independent of treatment conditional on the propensity score. The aim of the propensity score matching is to eliminate the dimension of conditioning by pairing treated and non treated units which have the same (or very similar) values of *P*(*X*), though possible different values of the single *X*s. In this sense the (4) can be rewritten as:

$$ATT = E(Y_1 \mid D=1, P(X)) - E(Y_0 \mid D=0, P(X)) \qquad (7)$$

To operationalise the propensity score matching estimation of the ATT, in the following empirical application a multi-step protocol is applied (Caliendo and Kopeinig, 2008). At first, the propensity score is estimated with a probit model that includes as covariates all the variables that are expected to affect the outcome and the treatment status.

Then, as a second step, a set of different algorithms is chosen. In the following empirical application the use of more matching procedures provides information on the stability and reliability of the emerging evidences. In particular three types of algorithms developed in the literature (e.g. Becker and Ichino, 2004; Cameron and Trivedi, 2005; Smith and Todd, 2005; Caliendo and Kopeinig,

[6] As the interest is on the treatment effect on treated the common support condition can be relaxed and written as Pr (D=1|X) <1. This guarantees the presence of suitable counterfactual units for each treated (Smith and Todd, 2005).

2008) are implemented: 5 nearest neighbours (5NN), caliper and kernel. To provide a better explanation of the different algorithm it is useful to introduce the following general notation (Smith and Todd, 2005) for the propensity score matching estimation of the ATT:

$$ATT = \frac{1}{N_1} \sum_{i \in I_1 \cap Sp} \left[Y_{1i} - \hat{E}\left(Y_{0i} \mid D = 1, P_i\right)\right] \quad (8),$$

with the counterfactual being defined as

$$\hat{E}\left(Y_{0i} \mid D = 1, P_i\right) = \sum_{j \in I_0} W(i, j) Y_{0j} \quad (9)$$

and where I_1 denotes the set of participants, I_0 the set of non participants, Sp the region of common support (see below) and $P(X)$ for simplicity is P. The match for each participant $i \in I_1 \cap Sp$ is constructed as a weighted average over the outcomes of non participants, where the weights $W(i, j)$ depend on the distance between P_i and P_j. 5NN matching is a variant of the single nearest neighbour matching, where the set of control units j selected as matches for each treated i, i.e. $C(P_i)$, is such that:

$$C(P_i) = \min_j \left\| P_i - P_j \right\| \quad (10)$$

More precisely, in the 5NN matching, the counterfactual for each treated unit is given by the mean outcome of the five non treated persons with the closest propensity score. With respect to the single nearest neighbour procedure, 5NN implies a trade-off between lower variance (more information is used to create the counterfactual) and an increased bias in the estimation (some dissimilar non treated units can be used as matches). Caliper matching reduces this potential bias by imposing a maximum tolerance , ε (i.e. 0.02 in the following application), to the distance in the propensity score values between treated and non treated units:

$$C(P_i) = \left\{ P_j \mid \ \left\| P_i - P_j \right\| < \varepsilon \right\} \quad (11)$$

To increase the possibility to find good matches in both the 5NN and caliper algorithms the replacement is allowed, i.e. non treated can be matched with more than one treated. The last algorithm employed is the kernel matching:

$$ATT = \frac{1}{N_1} \sum_{i \in I_1} \left[Y_{1i} - \frac{\sum_{j \in I_0} Y_{0j} G\left(\frac{P_j - P_i}{a_n}\right)}{\sum_{k \in I_0} G\left(\frac{P_k - P_i}{a_n}\right)} \right] \quad (12),$$

where $G(\cdot)$ is a kernel function (i.e. Epanechnikov) and a_n a bandwith parameter (i.e. 0.06). With respect to the other two procedures, which use a limited number of controls for each treated unit, kernel matching creates the counterfactual for each participants using the information from all the entire set of non treated, thus involving a trade-off between lower variance (more information is used) and higher bias (on average the similarity between treated and controls is expected to be lower).

The third step consists of imposing the common support condition to the matching algorithms. In what follows a "minima-maxima comparison" is applied. Following the *psmatch2* STATA procedure (Leuven and Sianesi, 2003), treatment observations whose propensity score is higher than the maximum or less than the minimum propensity score of the controls are dropped. In addition to this, a 5% “trim” is also imposed to the 5NN algorithm; this results in dropping treatment observations at which the propensity score density of the controls is the lowest.

The last step consists of assessing the quality of the matching. The basic idea is to compare the situation after and before the matching to check whether any differences in the covariates remain after conditioning on the propensity score. The following theorem suggested by Rosenbaum and Rubin (1983) helps to clarify this point:

$$X \perp D \mid P(X) \tag{13},$$

This implies that after conditioning on $P(X)$, additional conditioning on X should not provide any further information on the treatment status. To check the quality of matching four tests are employed. The first is a regression-based T-test on differences in the covariates means, for which it is expected that after the matching all the covariates are not able to significantly predict the treatment status. The second is a loglikelihood ratio test, for which after the matching the covariates included in the specification of the probit model for the propensity score estimation are expected to be jointly non significant. The third is a pseudo R^2 test. In this case the goodness of fit of the probit model is expected to collapse after the matching. The fourth is a test on the standardised bias[7], which is passed if after the matching the standardised bias is reduced below 3%-5% (Caliendo and Kopeinig, 2008)[8].

Propensity score matching is not only the basis for the estimation of the ATT, i.e. the additionality of the public support schemes, but also of the tentative analysis of the "risk of failure" of the policies. The basic idea is to analyse whether a high (low) additional effect is characterised also by a high (low) level of dispersion. To this purpose, at first, *i-th* firm's effects are calculated by subtracting from the value of the outcome variable of each supported firm *i* the average outcome of its counterfactual, obtained with a 5NN procedure. Then, for each additionality measure considered (see Section 3.3), a coefficient of variation of these *i-th* firm's effects is calculated. Furthermore, to have comparable ATTs across the different additionality measures, normalised ATTs are obtained by dividing each ATT by the overall average counterfactual outcome (i.e. $E(Y_0| D{=}0, P(X))$ obtained from the 5NN matching. Finally, a Spearman's rank correlation coefficient is calculated. This captures to what extent the rank of the normalised ATT, calculated for each additionality measure, is related to the rank of the corresponding coefficient of variation.

3.2 The Community Innovation Survey

The following empirical application is carried out by employing data coming from the fourth wave of the Community Innovation Survey (CIS4). As all the CIS waves, this is based on an harmonized questionnaire which is the same for all the European countries, thus allowing for comparable results. In addition to firm's characteristics, the CIS4 dataset includes information on: (i) product and process innovations; (ii) innovative inputs and expenditures; (iii) public funding; (iv) sources of information; (v) cooperation agreements; (vi) effects of innovation; (vii) hampering factors; (viii) intellectual propriety rights; (ix) organisational and marketing innovation; (x) effects of organisational innovation. The information gathered through the harmonised questionnaire of the CIS4 refers generally to the

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[7] Standardised bias is calculated both after and before the matching as:

$$SB_{before} = 100 \cdot \frac{(\bar{X}_1 - \bar{X}_0)}{\sqrt{0.5 \cdot (V_1(X) + V_0(X))}}, \text{ and } SB_{after} = 100 \cdot \frac{(\bar{X}_{1M} - \bar{X}_{0M})}{\sqrt{0.5 \cdot (V_{1M}(X) + V_{0M}(X))}}, \text{ with}$$

$\bar{X}$ being the mean of the covariates and $V(X)$ their variance.

[8] The results of the tests, which are not reported in the following pages but available upon request, largely support the quality of all the employed matching procedures. The only slightly non satisfactory test is the one on the standardised bias: through all the sixteen matching procedures only for five covariates the SB_{after} is found to be slightly higher (6.1% at the most) than the threshold indicated by Caliendo and Kopeinig (2008).

period 2002-2004, however some of the variables capture particular aspects in the last year of the reference period[9] or both in the first and last year[10].

Eurostat offers the possibility to access to a CIS4 dataset containing anonymised microdata[11]. The anonymisation of the data eliminates formal identifiers such as the name or exact address of the enterprises, while some firm's characteristics (i.e. country of the head-office, sector, size) are recoded into less punctual variables. In addition to this, Eurostat micro-aggregates the data. The resulting database consists of the same number of units as kept in the original database: artificial units are created by replacing original values by the mean (for quantitative variables) or mode value (for qualitative variables) within clusters of three observations[12] formed of individuals of 'maximum similarity' (i.e. with the nearest value). The variables in the original dataset are micro-aggregated independently of each other (i.e. clusters are established separately for each specific variable). This process, as mentioned, does not reduce the number of observations, which is actually quite high. More precisely, the dataset used in the following empirical application originally consists of 18,946 observations for Spain and 21,854 for Italy. Nevertheless, in order to provide a proper additionality evaluation of the regional and national policy interventions the size of the working dataset is reduced[13]. That because of three main reasons. At first, the analysis is limited to manufacturing firms. Second, in order to have the complete range of variables for all the observations, firms with unexpected missing values and firms that had not to fill the entire questionnaire[14] are dropped. Finally, to provide a proper additionality evaluation of the regional (national) policies, the working dataset is limited to have among treated units only firms that obtained a regional (national) funding, while among the control units only firms that did not receive any type of public support.

3.3 Variables

To operationalise the econometric approach presented above, at first, dummy variables that capture the firms' treatment status are needed. To this purpose four dummies on public funding are used. These reflect whether the firm received some funding by the regional or local (FUNLOC), the national (FUNGMT) or the European (FUNEU) levels of government and whether the European support was granted within the 5th or 6th European Framework Programme for Research and Technical Development (FUNRTD). The inclusion of these dummy variables allows for the identification of the firms supported by the regional or by the national level of government, but also of the firms that were not funded by any type of policy. This, in turn, permits the identification of treated and control groups for the additionality evaluation of the regional and national policies through propensity score matching.

Furthermore, by using the CIS4 database, it is possible to use and create a number of additionality measures, i.e. outcome variables[15], to capture input, output and behavioural additionality.

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[9] Turnover due to product innovations new to the firm or to the market; expenditure for intramural and extramural R&D; expenditure for machinery, equipment and software; expenditure for external knowledge and total expenditure for innovative activities.

[10] Turnover and size

[11] For 16 European countries (i.e. Belgium, Bulgaria, Czech Republic, Germany, Estonia, Spain, Greece, Hungary, Italy, Latvia, Lithuania, Norway, Portugal, Romania, Slovakia, Slovenia).

[12] In some cases 4 if the number of records is not a multiple of 3.

[13] See Section 4 for the actual number of observations used for the ATT evaluation of Italian and Spanish regional and national policies.

[14] Those companies that in the period 2002-2004 did not introduce any product or process innovations and did not carry out any innovation activities.

[15] Unless differently reported outcome the variables listed below are referred to entire period 2002-2004.

As for the input additionality these are: (i) the expenditure in intramural R&D in year 2004 (RDEXP); (ii) the intensity of the intramural R&D investment (RDINT) on the turnover in year 2004.

As for the output dimension the considered outcome variables are: (i) a dummy for product innovation (PRODINNO); (ii) a dummy for process innovation (PROCINNO); (iii) the percentage of turnover in year 2004 due to product innovations introduced in 2002-2004 that were new to the market (TURNMAR); (iv) the percentage of turnover in year 2004 due to product innovations introduced in 2002-2004 that were new to the firm (TURNIN); (v) the sum of TURNIN and TURNMAR (TURNINNO)[16]; (vi) a dummy for patent application (PROPAT).

Concerning the behavioural dimension two types of impact are considered: the effect of the policy interventions on the acquisition of competences and on the interactions of the supported firms. As for the analysis of the impacts on the acquisition of competences and capabilities the main outcome variable is a dummy for the engagement in formal training programmes (TRAINENG). As for the effects on interactions, knowledge transfer and networking activities two types of outcome variables can be used. First, two dummies capture respectively cooperation agreements with firms (COOPFIRM) and research organizations (COOPORG)[17]. Second, two dummies identify the acquisition of relevant information from other firms (INFOFIRM) and from universities or private research institutes (INFOORG)[18].

To employ the econometric strategy described above, in addition to the outcome variables, it is necessary to create suitable covariates *X*. Drawing on recent studies that evaluate the additionality of innovation policy interventions by adopting a propensity score matching approach (e.g. Czarnitki and Licht, 2006; Aerts and Shmidt, 2008; Busom and Fernandez-Ribas, 2008), a set of firm's characteristics are identified and included in the propensity score specification[19] (See Tab. A1 in the Appendix). First of all, a variable for the logarithm of the turnover (ln_TURN02) and the three dummies SMALL, MEDIUM and LARGE control for the firm's size. Participation and innovation strategies, however, could be affected also by the sector in which the firm operates: on the one hand policy intervention might be targeted to specific and strategic industries, on the other hand, firms belonging to more advanced sectors could be more able and willing to apply for the public support with well-promising projects. A series of dummies (SEC_DA-SEC_DN) capturing the manufacturing

[16] TURNMAR TURNIN and TURNINNO are rescaled from 0 to 1.

[17] COOPFIRM is "exploded" in different dummies, capturing cooperation agreements with national (COOPGPNAT) and foreign firms belonging to the same group (COOPGPFOR); national (COOPSUPNAT) and foreign suppliers (COOPSUPFOR); national (COOPCUSNAT) and foreign customers (COOPCUSFOR); national (COOPCOMNAT) and foreign competitors (COOPCOMFOR). Similarly COOPORG is further specified to capture the cooperation with: national (COOPINSNAT) and foreign private R&D institutes and commercial labs (COOPINSFOR); national (COOPUNINAT) and foreign universities (COOPUNIFOR); national (COOPPUBNAT) and foreign governments or public research institutes (COOPPUBFOR). ATT estimation for these specific types of cooperation are provided in the Appendix.

[18] These dummies are created from the four-point likert scales, included in the CIS4 dataset, that indicate the importance of different sources of information for the firm's innovation activities. The dummies takes value 1 if the relevance of the information is "medium" or "high". INFOFIRM captures information coming from suppliers (INFOSUP), customers (INFOCUS) and competitors (INFOCOM). INFOORG includes information sourcing from universities (INFOUNI) and private research institutes (INFOINS). ATT estimations for these specific types of information sourcing are provided in the Appendix.

[19] As the treatment dummies FUNLOC and FUNGMT cover the 2002-2004 period, in order to avoid endogeneity problems, whenever possible, the propensity scores specification includes variables referred to the first year of the period (2002). This can be done ln_TURN02, SMALL, MEDIUM and LARGE.

sector in which the firm operates are thus included[20]. Furthermore, aspects pertaining to the governance and ownership of the firm are controlled for with the inclusion of two dummies indicating respectively whether the firm belongs to a group (GP) and whether it is an affiliate of a multinational corporation (MNCGROUP). Whereas belonging to a group might increase the information, available through network channels, on existent policy schemes and thus the likelihood of being supported by the policy, being a MNC-affiliate might reduce the participation as parent companies might be more willing to file subsidy applications in the home country. Another firm's characteristic that is expected to affect the probability to participate in the policy programmes and the innovation strategy pertains to the engagement in foreign markets (EXPORT). Firms that face the international competition are indeed expected to be more aware of the need to innovate and thus probably more willing to apply for policy programmes that support their innovative activities. Another important aspect is whether the firm is engaged in R&D. For this reason two dummies, RDENG and RDCONT, are included. The first captures whether the firm is engaged in R&D, the second whether this engagement is continuous. Of course, both of them are expected to have a positive effect on the participation in support schemes, as firms that are strongly committed to formal R&D activities are supposed to be more willing and able to apply, successfully, for the public funding. Another factor that might influence the innovation behaviours and the participation status is the firm's financial constraint. Two set of dummy variables are thus included in the probit estimations of the propensity score. The first of these (HFENT1, HFENT2, HFENT3) captures whether the firm faces a “nil or low”, “medium” or “high” lack of internal funding. Similarly HFOUT1, HFOUT2, HFOUT3, captures whether the firm faces a “nil or low”, “medium” or “high” problems in accessing to external funding. In this case, it is expected that, at least up to a certain point, the more the firm faces a lack of internal or external funding, the more it might wish to be supported by the policy in order to compensate for the financial constraint. Differently from previous studies, this research takes into consideration also some informational aspects for the estimation of the propensity score. Three dummies (SMGT1, SGMT2, SGMT3) indicate respectively the relevance (“nil or low”, “medium”, “high”) of the governmental sources of information for the firm's innovative activities. Obviously, the information acquired from the government is supposed to positively affect the knowledge about possible support schemes, and, in turn, the probability to participate in the policy programmes and to shape the innovation behaviour consistently with the desired policy objectives. Similarly, other three dummies indicate the relevance of the information coming from professionals and industry associations (SPRO1, SPRO2, SPRO3). Professionals and industry associations are indeed expected to play a crucial role in supporting firms to gather information about possible public interventions, to file applications for support schemes and to fulfill policy requirements in terms of objectives to be achieved[21].

[20] Italian firms belonging to NACE rev. 1.1 19 (i.e. secDC in the CIS4 sectoral classification), 20 (belonging to sec20-21) and 23 (belonging to secDF-DG) are dropped from the working sample, as for these sectors the anonymisation process carried out by the Italian National Statistical Institute resulted in the aggregation of medium and large firms into a unique dimensional class. Firms belonging to NACE rev. 1.1 30 (belonging to secDL) are drooped as well, as for these the anonymisation process resulted in the aggregation of small, medium and large firms into a unique dimensional class.

[21] LARGE, HFENT1, HFOUT1, SGMT1, SPRO1, SEC27 (i.e. NACE rev 1.1 sector 27) are used as reference terms, thus are excluded from the probit model for the propensity score estimation.

4. Results

4.1 Italian regional policies

The additionality evaluation of the Italian regional policies is carried out on a sample of 2,006 manufacturing firms (599 supported and 1,407 potential controls). As it emerges from Tab. 1 regional policies in Italy, during the considered period, are generally characterized by a low level of additionality and in some case they seem to induce negative impacts on the innovation activities of supported firms.

Tab. 1 Additionality of regional policies in Italy

	NN5		**CALIPER (0.02)**		**KERNEL**		**TRIM (5)**	
	ATT	SE	ATT	SE	ATT	SE	ATT	SE
Input add.								
RDEXP	42295.320	67483.270	43382.720	67180.760	23791.990	47706.630	45794.740	71086.020
RDINT	0.003	0.002	0.003	0.002	0.002	0.002	0.003	0.002
Output add.								
PRODINNO	-0.047 *	0.028	-0.058 **	0.029	-0.050 **	0.023	-0.063 **	0.031
PROCINNO	0.122 ***	0.031	0.118 ***	0.029	0.111 ***	0.023	0.133 ***	0.033
TURNMAR	0.002	0.013	-0.003	0.012	-0.002	0.010	0.002	0.013
TURNIN	-0.021 **	0.010	-0.025 **	0.010	-0.016 *	0.009	-0.022 *	0.012
TURNINO	-0.019	0.017	-0.028 *	0.016	-0.017	0.013	-0.019	0.015
PROPAT	-0.023	0.026	-0.019	0.025	-0.007	0.020	-0.021	0.025
Behavioural add.								
TRAINENG	-0.046 *	0.025	-0.046 *	0.027	-0.043 *	0.022	-0.052 *	0.027
COOPFIRM	-0.028	0.020	-0.028	0.018	-0.015	0.013	-0.040 **	0.019
COOPORG	-0.019	0.016	-0.019	0.016	-0.012	0.013	-0.028 *	0.017
INFOFIRM	-0.059 ***	0.022	-0.065 ***	0.024	-0.043 **	0.020	-0.065 ***	0.023
INFOORG	0.097 ***	0.029	0.101 ***	0.028	0.097 ***	0.027	0.095 ***	0.031
N treat. on support	598		598		598		570	
N treated total	599		599		599		599	
N non treated	1407		1407		1407		1407	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

At first, it is possible to notice the absence of input additionality. In this case it might be pointed out that the low scale of the regional contributions and the focus on less formalised innovation activities (Cefis and Evangelista, 2007; Barbieri et al. 2010) hampers the capacity to stimulate an additional investment in formal R&D. As for the output additionality, the policies seems to induce a sort of shift in the type of innovation introduced, from product to process innovation. With respect to non supported firms, funded companies are more likely (from +11.1% to 13.3%) to achieve a process innovation, but less likely to introduce a new or improved product (from -4.7% to -6.3%). This lower propensity is also reflected in the proportion of turnover due to incremental product innovations, which is found to be negatively affected by the policy intervention (from -1.6% to -2.5%). The evidence emerging from the behavioural additionality evaluation confirms the general low performance of regional innovation policies in Italy. Public interventions initiated by regional governments are found to be unable to sustain firms' formalized learning process. The likelihood of being engaged in formal training programmes is lower for supported firms than for similar non funded companies (from -4.3% to -5.2%). Looking at impacts on the networking activities, funded firms are generally not statistically different from non funded companies with respect to their general engagement in cooperation agreements[22]. Coming to the capacity of the policy interventions to stimulate firms' external knowledge sourcing it is possible to notice, on the one hand, a general positive impact when the acquisition of information from research organisations is considered (from +9.5% to +10.1%); on the other hand, a negative (and smaller in absolute value) impact is found to characterise regional policies when information sourcing from other companies is considered (form -4.3% to -6.5%)[23].

As it emerges from Tab. A6 in the Appendix, Italian regional policies are not characterised by a significant correlation between the effects of the interventions and the dispersion of the impacts. The Spearman's ranks correlation coefficient, even if negative, is not significant. Hence, the rank of the ATT calculated for each additionality measure is not significantly correlated to the rank of corresponding coefficient of variation.

4.2 Italian national policies

As it emerges from Tab. 2 the additionality profile of the interventions initiated by the central government in Italy, emerging from an evaluation carried out on a sample of 1,845 firms (438 supported and 1,407 potential controls), is completely different from the one of the regional policies.

At first it is possible to notice that national Italian policies are characterised by input additionality effects. Public interventions induce firms to invest an additional amount of resources in intramural R&D activities (from + 427,914.1 Euros to + 447,613.6 Euros). This is reflected in an increased intensity of R&D investment (from +0.6% to +0.7%). However, the increased amount of formal inputs allocated to innovation activities does not result in a higher capacity to introduce product and/or radical innovation. In fact, despite a positive effect on the propensity to introduce new or improved processes is (from +8.3% to + 9.6%) no significant effect, in the considered period, is found to be in place for the other output additionality measures. Nevertheless, such a result might be only due to the limited time span of the analysis, positive output additionality effect might indeed emerge in a longer-term, especially considering the positive effects of the policy interventions on the firms' innovation beahviour. In particular, national policies are found to affect firms' propensity to engage in R&D cooperation with both other firms (from +4.9% to +5.2%) and, to a larger extent, with research partners (from +10.3% to 11.6%)[24]. This latter type of effect is associated to an in increased propensity to be engaged in relevant information sourcing from universities and private R&D institute (from +10.8% to +11.3%)[25].

[22] Funded companies are found to be less likely to be engaged in collaboration with national competitors (see Tab. A2 in the Appendix).

[23] Looking at the different types of information sourcing (see Tab. A2 in the Appendix) it is possible to notice a positive impact on the acquisition of relevant knowledge from private R&D institutes and commercial labs, while a negative impact is found for the acquisition of information from universities and suppliers.

[24] As it emerges from Tab. A3 in the Appendix, Italian national policies increase the propensity to cooperate with national and global suppliers, national private R&D institutes and commercial labs and national universities.

[25] See Tab. A3 in the Appendix for a detail.

Tab. 2 Additionality of national policy in Italy

	NN5		CALIPER (0.02)		KERNEL		TRIM (5)	
	ATT	SE	ATT	SE	ATT	SE	ATT	SE
Input add.								
RDEXP	429066.1 *	238670.7	427914.1 *	228623.0	447613.6 **	218544.8	313001	261069.2
RDINT	0.007 **	0.003	0.007 **	0.003	0.006 **	0.003	0.007 **	0.003
Output add.								
PRODINNO	0.004	0.034	0.005	0.034	0.006	0.025	0.000	0.033
PROCINNO	0.086 **	0.036	0.086 **	0.035	0.096 ***	0.027	0.083 **	0.037
TURNMAR	-0.002	0.013	-0.001	0.015	-0.005	0.010	-0.002	0.013
TURNIN	0.016	0.012	0.016	0.014	0.013	0.011	0.015	0.012
TURNINO	0.014	0.018	0.014	0.017	0.007	0.014	0.013	0.018
PROPAT	0.047	0.030	0.048	0.031	0.061 ***	0.024	0.041	0.030
Behavioural add.								
TRAINENG	0.007	0.032	0.005	0.033	0.010	0.029	-0.002	0.032
COOPFIRM	0.051 **	0.026	0.050 *	0.026	0.052 ***	0.019	0.049 **	0.023
COOPORG	0.104 ***	0.027	0.103 ***	0.025	0.116 ***	0.022	0.108 ***	0.024
INFOFIRM	-0.010	0.025	-0.009	0.027	-0.015	0.022	-0.014	0.026
INFOORG	0.113 ***	0.035	0.112 ***	0.036	0.108 ***	0.027	0.111 ***	0.038
N treat. on support	433		433		433		417	
N treated total	438		438		438		438	
N non treated	1407		1407		1407		1407	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

This picture on the Italian national policies emerging from the evaluation of the ATT is associated to an interesting relation between the effects of the policies and their dispersion. A Spearman's rank's correlation coefficient of -0.8462, significant at the 99% level (See Tab A5 in the Appendix), reflects a situation in which a high ATT is correlated to a low dispersion of the effect. In this sense national policy interventions in Italy are characterised by a "low risk of policy failure".

4.3 Spanish regional policies

Tab. 3 reports the results of the additionality evaluation of the regional policies implemented in Spain, which is carried out on a sample of 4,110 firms (879 supported and 3,231 potential controls). As far as the input additionality is concerned, like in the case of Italian policies initiated at the regional level, no significant effect is found to be in place, probably because of the low scale of the contribution granted by the regional governments and the greater focus on less formalised innovation activities (Garcia-Quevedo and Afcha-Chávez, 2009; Afcha-Chávez, 2011). However, considering output and in particular behavioural additionality, the range of the effects induced by Spanish regional interventions is broader than the one of Italian regional policies. Despite the absence of impacts on the allocation of formal innovation input, Spanish regional support schemes are characterised by a positive effect (even if slightly significant) on the probability to introduce product innovations (from +3.8% to +3.9%) and, in particular, by an impact on the capacity to exploit the introduced radical product innovations, i.e. to increase the percentage of turnover due to this type of innovations (from + 1.5% to +1.8%). This higher innovation performance is coupled with a positive effect on the propensity to file patent applications (from +6.0% to +7.2%). As for the behavioural additionality, Spanish regional policies are found to induce a large set of changes in supported companies, both with respect to the improvement of the learning process and the increased interactions with external sources of knowledge. More precisely, it can be noticed a positive impact on the engagement in formal training programmes (from +4.8% to +6.1%). Moreover, policy supports are found to enhance firms' propensity to cooperate with both other firms (from +7.3% to +7.5%) and research organizations (from +9.6% to +10.3%)[26]. Looking at the results pertaining to the external information sourcing it is noticeable how regional policies in Spain stimulate funded firms to acquire relevant knowledge from research organizations (from +10.5% to 12.1%) but not from other firms[27].

Finally, as for the Italian national policy interventions, also the Spanish regional ones are characterised by a "low risk of policy failure". A Spearman's rank's correlation coefficient of -0.6593, significant at the 95% level (see Tab A5 in the Appendix), denotes a negative relation between the ATTs and the dispersion of the impacts.

Tab. 3 Additionality of regional policy in Spain

	NN5		**CALIPER (0.02)**		**KERNEL**		**TRIM (5)**	
	ATT	*SE*	*ATT*	*SE*	*ATT*	*SE*	*ATT*	*SE*
Input add.								
RDEXP	-5305.556	34001.730	-5352.441	34923.640	17351.620	20613.090	-7059.569	35644.120
RDINT	0.154	0.151	0.154	0.147	0.156	0.139	0.161	0.147
Output add.								
PRODINNO	0.038 *	0.022	0.039 *	0.023	0.039 *	0.021	0.038	0.025
PROCINNO	0.022	0.023	0.023	0.025	0.042 **	0.019	0.023	0.026
TURNMAR	0.017 *	0.009	0.017 *	0.009	0.015 **	0.007	0.018 **	0.008
TURNIN	0.002	0.014	0.001	0.013	0.001	0.011	-0.001	0.013
TURNINO	0.019	0.016	0.019	0.014	0.016	0.013	0.017	0.015
PROPAT	0.068 ***	0.020	0.068 ***	0.020	0.060 ***	0.016	0.072 ***	0.021
Behavioural add.								
TRAINENG	0.048 **	0.023	0.048 **	0.022	0.061 ***	0.018	0.048 **	0.024
COOPFIRM	0.073 ***	0.021	0.075 ***	0.020	0.073 ***	0.015	0.073 ***	0.019
COOPORG	0.099 ***	0.018	0.099 ***	0.016	0.103 ***	0.013	0.096 ***	0.017
INFOFIRM	0.019	0.018	0.021	0.020	0.020	0.013	0.017	0.020
INFOORG	0.105 ***	0.021	0.105 ***	0.022	0.121 ***	0.019	0.115 ***	0.023
N treat. on support	876		874		876		836	
N treated total	879		879		879		879	
N non treated	3231		3231		3231		3231	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

[26] A positive and significant effect is found for the cooperation with national firms belonging to the same group to, national suppliers and national competitors. As for the cooperation with research partners, a positive effect is found for the collaboration with national private R&D institutes, national universities and national government or public research agencies (See Tab. A4 in Appendix).

[27] In particular from private R&D institute and universities (See Tab. A4 in the Appendix).

4.4 Spanish national policies

The results of the additionality evaluation presented in Tab. 4 pertain to policies implemented by the central government in Spain. In this case the sample is made of 3,795 firms (564 treated and 3,231 potential controls).

Tab. 4 Additionality of national policies in Spain

	NN5		CALIPER (0.02)		KERNEL		TRIM (5)	
	ATT	*SE*	*ATT*	*SE*	*ATT*	*SE*	*ATT*	*SE*
Input add.								
RDEXP	367677.1 **	162523.3	371922.7 **	164501.7	359347.8 ***	132797.8	354036.2 **	156419.1
RDINT	0.071	0.049	0.072	0.046	0.075	0.054	0.074	0.050
Output add.								
PRODINNO	0.001	0.027	0.001	0.028	0.014	0.022	0.015	0.030
PROCINNO	0.022	0.030	0.026	0.028	0.037	0.023	0.012	0.029
TURNMAR	0.037 ***	0.011	0.038 ***	0.012	0.040 ***	0.010	0.040 ***	0.011
TURNIN	-0.013	0.015	-0.012	0.016	-0.018	0.013	-0.009	0.015
TURNINO	0.024	0.019	0.026	0.018	0.022	0.015	0.032 *	0.019
PROPAT	0.059 **	0.025	0.062 ***	0.023	0.064 ***	0.020	0.073 ***	0.025
Behavioural add.								
TRAINENG	0.060 **	0.030	0.061 **	0.031	0.051 **	0.026	0.060 *	0.032
COOPFIRM	0.086 ***	0.026	0.086 ***	0.029	0.081 ***	0.020	0.081 ***	0.025
COOPORG	0.111 ***	0.021	0.113 ***	0.023	0.110 ***	0.019	0.105 ***	0.023
INFOFIRM	0.061 ***	0.024	0.061 ***	0.023	0.050 ***	0.018	0.070 ***	0.024
INFOORG	0.100 ***	0.026	0.100 ***	0.028	0.116 ***	0.021	0.101 ***	0.028
N treat. on support	564		564		564		536	
N treated total	564		564		564		564	
N non treated	3231		3231		3231		3231	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

Like in the Italian case, input additionality effects are found to be in place only when the national interventions are considered. In the case of Spain, policy supports stimulate an additional investment in intramural R&D (from + 354,036.2 Euros to + 371,922.7 Euros), however a similar positive effect is not found for the intensity of R&D investment. As for the output additionality, the effects are quite similar to those characterising the policies initiated at the regional level. Spanish national policies enhance the capacity to exploit the introduced radical product innovations, i.e. to increase the percentage of turnover due to this type of innovations (from +3.7% to +4.0%), and the propensity to file patent applications (from + 5.9% to +7.3%). In addition to this, a number of behavioural changes in the supported firms' innovation process are found to be induced by the public support. At first, funded firms are more likely to be engaged in training programmes (from +5.1% to +6.0%). Looking at the impacts on the interactions of the funded companies, national policies enhance the propensity to cooperate with both research organizations (from +10.5% to +11.3%) and other firms (from +8.1% to

+8.6%)[28]. This increased propensity to interact with business and research partners is associated to an effect on the capacity of funded firms to acquire relevant information from both other firms (from +5.0% to +7.0%) and research organizations (from +10.0% to +11.6%)[29].

Also in the case of the national interventions implemented in Spain the "risk of policy failure" is low. More precisely a Spearman's rank's correlation coefficient of -0.6099, significant at the 95% level, (See Tab. A5, in the Appendix) denotes that the higher is the ATT, the lower is its dispersion.

5. Concluding remarks

Through the paper an analysis of the policy implemented in two southern EU countries has been provided. This has been carried out through an evaluation of the additionality and of the "risk of policy failure" characterising the interventions implemented in Italy and Spain. In doing this, a multi-dimensional approach and a multi-level perspective have been adopted. This has allowed for the investigation of the input, output and behavioural additionality of public interventions implemented both at the regional and national levels. The evidence emerging from the propensity score matching algorithms implemented to estimate the ATT on the selected additionality measures has allowed for the identification of the overall effectiveness of the policies considered. Among the others, some interesting results are worth of mentioning in these concluding remarks. At first, both in Italy and in Spain, regional policies are not characterised by input additionality effects. This seems to be coherent with the characteristics of interventions initiated at the sub-national level in the two countries: a low amount of public contribution and a greater focus on less formalised types of innovation activities. However, whereas in Spain the lack of input additionality of the regional policies is associated to a good performance in the other additionality dimensions, this is not the case for the Italian regional interventions, which are characterised by a general weak effectiveness. The reason for such a result deserves a deeper investigation, which has necessarily to consider the heterogeneity of the regional policies, and thus of their effects, and the fact that the period considered in this analysis (2002-2004) is only immediately subsequent to the reform of the Italian constitution, approved in 2001, which gave to regions a greater autonomy in terms of industrial policy. Another interesting aspect emerged in the analysis pertains to the substantial differences between the output additionality of Italian and Spanish policies. Whereas the former are characterised only by the capacity to stimulate process innovation, the latter are found to be able to enhance the economic exploitation of the radical innovation introduced as well as patent applications. In this sense the Italian multi-level system of policy does not seem to be able to trigger a quality leap in the performances of the overall national system of innovation. Whether the positive effects induced by the Italian national interventions on the innovation behaviours can affect in the long-run the capacity to introduce qualitatively advanced innovations is a question which remains open to further investigations. A third aspect which emerged through the paper is the spectrum of effects induced by the public support schemes on the innovation behaviours of the beneficiaries. Apart from the Italian regional supports, policies are found to induce

[28] From Tab. A5 in the Appendix, it is possible to notice an increase in the propensity to cooperate with national firms in the same group, national suppliers, national and foreign competitors. As for the cooperation with research organizations, national policies increase in particular the propensity to cooperate with national private R&D institutes and national universities.

[29] Funded firms are induced to recur to information sourcing from customers, private R&D institutes and universities (See Tab. A5 in the Appendix).

funded firms to interact more with other companies and research organisations. In addition to this Spanish policies, both regional and national, are found to increase the engagement of firms in formal training programmes.

The paper has provided also a tentative analysis of the “risk of policy failure”. From the analysis of the Spearman’s rank correlation coefficients, with the only exception of the Italian regional policy, the rank of the (normalized) ATTs is found to be negatively related to rank of the coefficients of variation. In other terms, the lower is the dispersion of the effects the higher is the ATT. Of course this evidence cannot point to general policy implications in absence of other similar studies that can extend the external validity of such a result.

The work is not free from limitations. The most important one is due to the cross-sectional nature of the data. This hampered the possibility to overcome the potential endogeneity of the participation in the policy. The availability of panel data would improve the robustness of the additionality evaluation by allowing clearer and more rigorous considerations on the causal relations.

Appendix

Tab. A1 Probit estimation of the propensity scores

	FUNLOC – Italy		FUNGMT – Italy		FUNLOC – Spain		FUNGMT – Spain	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
SMALL	0.185	0.159	-0.234	0.164	0.535 ***	0.101	-0.325 ***	0.095
MEDIUM	0.330 ***	0.123	-0.119	0.116	0.381 ***	0.096	-0.271 ***	0.086
lnTURN02	-0.029	0.034	0.066 *	0.038	0.009	0.006	-0.018 ***	0.006
GP	-0.250 ***	0.085	-0.002	0.088	-0.008	0.064	0.288 ***	0.067
MNC	-0.295 **	0.125	-0.346 ***	0.116	-0.203 **	0.093	-0.419 ***	0.093
EXPORT	-0.005	0.075	-0.004	0.088	0.011	0.055	0.053	0.070
RDENG	0.125	0.082	-0.035	0.096	0.215 ***	0.065	0.280 ***	0.086
RDCONT	0.295 ***	0.077	0.397 ***	0.089	0.069	0.063	0.357 ***	0.076
HFENT2	0.036	0.083	0.079	0.091	0.147 **	0.063	-0.014	0.072
HFENT3	0.083	0.100	-0.148	0.117	0.057	0.073	-0.079	0.087
HFOUT2	0.104	0.085	0.196 **	0.094	0.076	0.063	0.074	0.074
HFOUT3	-0.311 ***	0.099	-0.059	0.111	-0.035	0.071	-0.037	0.086
SPRO2	0.255 ***	0.085	0.106	0.093	0.116	0.060	-0.062	0.073
SPRO3	0.551 ***	0.134	0.117	0.159	-0.069	0.116	0.077	0.126
SGMT2	-0.056	0.192	0.667 ***	0.161	0.374 ***	0.093	0.496 ***	0.100
SGMT3	0.294	0.249	0.148	0.271	0.702 ***	0.197	0.576 ***	0.218
CONST.	-0.346	0.640	-1.603 **	0.715	-1.494 ***	0.194	-1.174 ***	0.219
Sectoral dummies	*Included*		*Included*		*Included*		*Included*	
N	2006		1845		4110		3795	
Prob>χ^2	0.000		0.000		0.000		0.000	
Pseudo R^2	0.059		0.077		0.039		0.098	

A VIF test leads to exclude the multicollinearity of the covariates (all the VIF values are lower than 10)

Tab A2. Behavioural additionlity effects on firms' interactions. Italian regional policies

	NN5		CALIPER (0.02)		KERNEL		TRIM (5)	
	ATT	SE	ATT	SE	ATT	SE	ATT	SE
COOPGPNAT	-0.010	0.008	-0.010	0.008	-0.009	0.006	-0.013	0.008
COOPGPFOR	0.001	0.005	0.001	0.005	0.000	0.004	0.001	0.005
COOPSUPNAT	-0.016	0.016	-0.016	0.015	-0.005	0.013	-0.024	0.017
COOPSUPFOR	0.001	0.004	0.001	0.004	0.000	0.003	0.001	0.003
COOPCUSNAT	-0.021	0.014	-0.021 *	0.012	-0.011	0.009	-0.027 **	0.011
COOPCUSFOR	-0.008	0.007	-0.008	0.008	-0.005	0.007	-0.010	0.008
COOPCOMNAT	-0.026 **	0.012	-0.026 **	0.010	-0.012	0.009	-0.031 ***	0.011
COOPCOMFOR	-0.001	0.006	-0.001	0.006	0.000	0.005	-0.001	0.006
COOPINSNAT	-0.010	0.014	-0.010	0.014	-0.005	0.012	-0.017	0.014
COOPINSFOR	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.004
COOPUNINAT	-0.013	0.012	-0.013	0.012	-0.012	0.010	-0.018	0.013
COOPUNIFOR	0.001	0.004	0.001	0.004	0.001	0.003	0.001	0.004
COOPPUBNAT	-0.004	0.006	-0.004	0.005	-0.004	0.004	-0.006	0.005
COOPPUBFOR	0.000	0.003	0.000	0.003	0.000	0.002	0.000	0.003
INFOSUP	-0.053 *	0.030	-0.059 *	0.030	-0.041 *	0.024	-0.053 *	0.030
INFOCUS	-0.005	0.031	0.000	0.034	0.008	0.027	-0.010	0.033
INFOCOM	-0.009	0.028	-0.004	0.031	0.008	0.025	-0.020	0.030
INFOINS	0.114 ***	0.029	0.119 ***	0.030	0.116 ***	0.024	0.118 ***	0.029
INFOUNI	-0.039 **	0.019	-0.038 **	0.019	-0.033 **	0.013	-0.040 **	0.017
N treat. on support	598		598		598		570	
N treated total	599		599		599		599	
N non treated	1407		1407		1407		1407	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

Tab A3. Behavioural additionlity effects on firms' interactions. Italian national policies

	NN5		CALIPER (0.02)		KERNEL		TRIM (5)	
	ATT	SE	ATT	SE	ATT	SE	ATT	SE
COOPGPNAT	0.012	0.014	0.012	0.015	0.013	0.013	0.010	0.015
COOPGPFOR	0.001	0.009	0.001	0.010	0.004	0.009	-0.003	0.009
COOPSUPNAT	0.046 **	0.020	0.045 **	0.023	0.049 ***	0.018	0.046 **	0.023
COOPSUPFOR	0.014 **	0.007	0.014 **	0.007	0.013 *	0.007	0.012 *	0.007
COOPCUSNAT	0.017	0.017	0.016	0.017	0.022	0.014	0.015	0.016
COOPCUSFOR	0.010	0.013	0.010	0.013	0.013	0.011	0.005	0.011
COOPCOMNAT	0.011	0.014	0.010	0.015	0.009	0.012	0.014	0.014
COOPCOMFOR	-0.004	0.007	-0.004	0.007	-0.003	0.006	-0.007	0.007
COOPINSNAT	0.072 ***	0.024	0.070 ***	0.021	0.081 ***	0.020	0.076 ***	0.022
COOPINSFOR	0.008	0.007	0.008	0.007	0.008	0.006	0.006	0.008
COOPUNINAT	0.093 ***	0.025	0.093 ***	0.023	0.103 ***	0.021	0.096 ***	0.023
COOPUNIFOR	0.001	0.006	0.001	0.005	0.002	0.005	0.001	0.006
COOPPUBNAT	0.018	0.012	0.017	0.012	0.017 *	0.010	0.020 *	0.011
COOPPUBFOR	0.000	0.001	0.000	0.001	-0.001	0.001	0.000	0.001
INFOSUP	-0.005	0.034	-0.004	0.034	-0.007	0.027	-0.004	0.035
INFOCUS	0.028	0.033	0.028	0.032	0.019	0.030	0.036	0.034
INFOCOM	0.006	0.033	0.004	0.033	0.003	0.029	0.016	0.032
INFOINS	0.100 ***	0.034	0.099 ***	0.033	0.094 ***	0.028	0.111 ***	0.037
INFOUNI	0.063 **	0.026	0.062 **	0.027	0.070 ***	0.021	0.059 **	0.027
N treat. on support	433		433		433		417	
N treated total	438		438		438		438	
N non treated	1407		1407		1407		1407	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

Tab A4. Behavioural additionlity effects on firms' interactions. Spanish regional policies

	NN5		CALIPER (0.02)		KERNEL		TRIM (5)	
	ATT	*SE*	*ATT*	*SE*	*ATT*	*SE*	*ATT*	*SE*
COOPGPNAT	0.018 **	0.009	0.019 **	0.008	0.016 **	0.007	0.018 **	0.008
COOPGPFOR	-0.002	0.006	-0.002	0.007	-0.002	0.005	-0.002	0.007
COOPSUPNAT	0.039 ***	0.014	0.041 ***	0.015	0.041 ***	0.012	0.037 **	0.015
COOPSUPFOR	0.008	0.009	0.008	0.009	0.008	0.008	0.007	0.010
COOPCUSNAT	0.011	0.012	0.012	0.011	0.012	0.009	0.012	0.011
COOPCUSFOR	0.003	0.008	0.003	0.007	0.004	0.006	0.000	0.008
COOPCOMNAT	0.016 *	0.009	0.018 *	0.010	0.018 **	0.008	0.019 **	0.009
COOPCOMFOR	0.003	0.005	0.003	0.004	0.001	0.004	0.003	0.005
COOPINSNAT	0.053 ***	0.012	0.053 ***	0.013	0.053 ***	0.011	0.052 ***	0.012
COOPINSFOR	0.009 *	0.005	0.010 *	0.005	0.008 *	0.005	0.008	0.005
COOPUNINAT	0.057 ***	0.013	0.058 ***	0.014	0.061 ***	0.012	0.055 ***	0.013
COOPUNIFOR	-0.001	0.003	-0.001	0.002	-0.001	0.002	-0.001	0.003
COOPPUBNAT	0.016 **	0.007	0.015 **	0.006	0.014 **	0.006	0.014 **	0.007
COOPPUBFOR	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.001
INFOSUP	0.013	0.023	0.014	0.024	0.022	0.018	0.012	0.024
INFOCUS	0.027	0.024	0.029	0.023	0.026	0.019	0.027	0.024
INFOCOM	0.010	0.022	0.012	0.024	0.001	0.016	0.009	0.025
INFOINS	0.052 **	0.020	0.053 **	0.021	0.065 ***	0.018	0.062 ***	0.020
INFOUNI	0.055 ***	0.016	0.056 ***	0.017	0.065 ***	0.015	0.062 ***	0.017
N treat. on support	876		874		876		836	
N treated total	879		879		879		879	
N non treated	3231		3231		3231		3231	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

Tab A5. Behavioural additionlity effects on firms' interactions. Spanish national policies

	NN5		CALIPER (0.02)		KERNEL		TRIM (5)	
	ATT	*SE*	*ATT*	*SE*	*ATT*	*SE*	*ATT*	*SE*
COOPGPNAT	0.029 **	0.014	0.029 *	0.015	0.026 **	0.012	0.023	0.014
COOPGPFOR	0.012	0.013	0.012	0.014	0.010	0.010	0.013	0.013
COOPSUPNAT	0.059 ***	0.020	0.059 ***	0.019	0.052 **	0.017	0.057 ***	0.018
COOPSUPFOR	0.013	0.015	0.013	0.014	0.014	0.012	0.010	0.014
COOPCUSNAT	0.025	0.016	0.025	0.017	0.016	0.014	0.028	0.017
COOPCUSFOR	0.015	0.013	0.015	0.013	0.012	0.010	0.010	0.011
COOPCOMNAT	0.029 **	0.013	0.029 **	0.012	0.026 **	0.010	0.027 **	0.011
COOPCOMFOR	0.022 **	0.009	0.022 **	0.010	0.021 ***	0.007	0.022 **	0.010
COOPINSNAT	0.053 ***	0.017	0.053 ***	0.019	0.054 ***	0.015	0.048 ***	0.016
COOPINSFOR	0.016 *	0.009	0.016	0.010	0.015 *	0.008	0.008	0.009
COOPUNINAT	0.086 ***	0.021	0.088 ***	0.020	0.090 ***	0.017	0.082 ***	0.019
COOPUNIFOR	0.004	0.005	0.004	0.006	0.004	0.005	0.002	0.005
COOPPUBNAT	0.020 *	0.011	0.020 *	0.010	0.020 **	0.010	0.015	0.010
COOPPUBFOR	0.000	0.002	0.000	0.003	0.001	0.002	0.000	0.002
INFOSUP	0.054 *	0.028	0.057	0.029	0.035	0.022	0.056 *	0.030
INFOCUS	0.058 **	0.028	0.062 **	0.027	0.054 **	0.023	0.064 **	0.034
INFOCOM	0.041	0.027	0.036	0.030	0.025	0.023	0.035	0.029
INFOINS	0.055 **	0.024	0.055 **	0.026	0.059 ***	0.022	0.059 **	0.028
INFOUNI	0.075 ***	0.024	0.079 ***	0.022	0.088 ***	0.020	0.068 ***	0.026
N treat. on support	564		564		564		536	
N treated total	564		564		564		564	
N non treated	3231		3231		3231		3231	

*, **, *** denote respectively a 90%, 95%, 99% level of significance. Standard errors are calculated with a 200-replication bootstrap procedure.

Tab. A6. Spearmans' rank correlation coefficients (on the main set of additionality measures)

Policy level and country	Spearman's rho	Prob>|t|	N additionality measures
Italian regional policies	-0.2527	0.4048	13
Italian national policies	-0.8462***	0.0003	13
Spanish regional policies	-0.6593**	0.0142	13
Spanish national policies	-0.6099**	0.0269	13

Tab A7. Spearmans' rank correlation coefficients (including specific types of cooperation and information sourcing)

Policy level and country	Spearman's rho	Prob>|t|	N additionality measures
Italian regional policies	0.1373	0.4536	32
Italian national policies	-0.7232***	0.0000	32
Spanish regional policies	-0.5876***	0.0004	32
Spanish national policies	-0.3845**	0.0298	32

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